Serbian Ceramic Society Conference
ADVANCED CERAMICS AND APPLICATION III
New Frontiers in Multifunctional Material Science and Processing

Serbian Ceramic Society
Institute of Technical Sciences of SASA
Institute of Chemistry Technology and Metallurgy
Institute of Physics
Institute for Technology of Nuclear and Other Raw Mineral Materials
Institute for Testing of Materials
Archeological Institute of SASA

PROGRAM AND THE BOOK OF ABSTRACTS

Serbian Academy of Sciences and Arts, Knez Mihailova 35
Sep 29th - Oct 1st, 2014, Belgrade, Serbia

Book title: Serbian Ceramic Society Conference - ADVANCED CERAMICS AND APPLICATION III: Program and the Book of Abstracts

Publisher:
Serbian Ceramic Society

Editors:
Prof.dr Vojislav Mitić
Prof. dr Olivera Milošević
Dr Nina Obradovic
Dr Lidija Mančić

Technical Editor:
Prof. dr Olivera Milošević

Printing:
Serbian Academy of Sciences and Arts,
Knez Mihailova 35, Belgrade
Format
Pop Lukina 15, Belgrade

Edition:
150 copies

Sculptural Concretes: Rajko D. Blažić, High School-Academy for Arts and Conservation, Serbian Ortodox Church, Belgrade, Serbia

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

666.3/.7(048)
66.017/.018(048)

SERBIAN Ceramic Society (Belgrade). Conference (3rd ; 2014 ; Beograd) Advanced Ceramics and Application : new frontiers in multifunctional material science and processing : program and the book of abstracts / III Serbian Ceramic Society Conference, 29th September - 1st October, Belgrade, 2014 ; [organized by] Serbian Ceramic Society ... [et al.] ; [editors Vojislav Mitić ... et al.]. - Belgrade : Serbian Ceramic Society, 2014 (Belgrade : Serbian Academy of Sciences and Arts). – 139 str. ; 30 cm

Tiraž 150.

ISBN 978-86-915627-2-4

1. Serbian Ceramic Society (Belgrade)
a) Керамика - Апстракти b) Наука о материјалима - Апстракти c) Наноматеријали - Апстракти

COBISS.SR-ID 209985036

OR2

Ultrasonic Processing of Hierarchically Organized TiO_2 Functional Nanomaterials

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Hierarchically organized functional nanomaterials are of interest for potential use in electrochemical, catalytic and gas-sensing applications due to their unique structural organization defined on different length scales. Here we present the application of the aerosol processing route in generation of hierarchically organized nanostructured TiO_2 particles. Particles are obtained by the thermal decomposition of aerosol generated by atomization of colloidal TiO_2 solution with a low-intensity ultrasound generator operating at the high frequency of 1.7 MHz. By a proper choice of the precursors type and concentration, as well as processing parameters (temperature of aerosol decomposition and the residence time of droplet/particle), fine control over both the submicron- and nanometer-length scales of spherically structured TiO_2 was achieved. The median diameter and the crystallite size of titania particles were found to be tunable from 350 to 450 nm and from 2.5 to 50 nm, respectively. Moreover, it was shown that the structural complexity of the particles synthesized at the lower processing temperatures might be further extended by their surface sensitization with several bidentate ligands. The results obtained demonstrate advantages of ultrasonic spray pyrolysis route in synthesis of hierarchically organized functional nanomaterials.